DOCUMENT RESUME

ED 280 491 IR 051 850

TITLE	IFLA General Conference, 1986. Management and Technology Division. Section: Information Technology. Papers.
INSTITUTION	International Federation of Library Associations and Institutions, The Hague (Netherlands).
PUB DATE	Aug 86
NOTE	56p.; Papers presented at the International Federation of Library Associations (IFLA) General Conference (52nd, Tokyo, Japan, August 24-30, 1986).
PUB TYPE	Speeches/Conference Papers (150)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Access to Information; Databases; Developed Nations; Foreign Countries; *Information Technology; International Organizations; Library Associations; *Library Automation; Library Materials; Multilingual Materials; *Online Systems; *Optical Disks; Shared Library Resources
IDENTIFIERS	Australia; *Bibliographic Data Bases; Information Management; Japan; *Nonroman Scripts

ABSTRACT

Four papers on information technology were presented at the 1986 International Federation of Library Associations (IFLA) conference. In the paper "Optical Disc Technology Used for Large-Scale Data Base," Naoto Nakayama (Japan) considers the rapid development of optical technology and the role of applications such as optical discs, optical fiber cables, and optical printers in structuring large-scale database systems. Seven figures supplement the text. In a report on the IFLA Pre-Conference Seminar on Automated Systems for Access to Multi-Lingual and Multi-Script Library Materials, Stephen W. Massil of the United Kingdom summarizes papers concerning the automation of non-Roman scripts. National and international standards, computer developments that fail to take library requirements into proper account, and the need for increased dialog between North America and East Asia are noted as areas of concern. "The Australian Bibliographic Network" by Warren Horton of Australia discusses the establishment of a national online bibliographic facility based on cooperative participation and the facility's impact on shared development of Australia's library services. Finally, in "The Role and Use of Information Technologies and Databases for the Development of Information Management in Japan," Hisamichi Yamazaki of Japan considers the application of leading-edge technologies to information management and documentation. (KM)

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IFLA

General Conference

Management & Technology Division

Section: Information Technology

Tokyo, Japan
August 1986

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IFLA GENERAL CONFERENCE, TOKYO
1986
Division: Management and Technology
Section: Information Technology

40-INF-1-E

Optical Disc Technology
Used for Large-Scale Data Base

by

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KEYWORD(S):

Technology
Optical Disc
Data Base
Japan

For internal use only: SI
To be brought to meeting no:
111
Remarks:
to be presented orally ☒
for distribution only ☐

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1. BACKGROUND

The purpose of information retrieval service systems using a data base is to sort intellectual resources, record them in large-capacity memories, and retrieve them through a communications network. On-line retrieval service systems using a data base can be roughly classified into the following two types:

(1) Centralized type: Using a centralized large-scale data base

(2) Distributed type: Sharing distributed data base

In Japan, on-line retrieval services started in 1981 in the form of type (1) as a character data base. Type (1) allows configuration of largescale systems by combining a large computer, a communications network, and retrieval terminals. For example, JICST and JAPATIC are used by the Patent Agency for patent data retrieval (; NEEDS-IR serves the Nihon keizai Shimbun for retrieval) of economic trends and other news data, and ICAS of KDD uses overseas data bases.

The Literature Information Center of Tokyo University[1] began the service of retrieving data on the books in the libraries of universities across the country from 1985. The Center registers and manages the 120 million books in the libraries of Japanese universities by on-line shared cataloging, and quickly provides, on-line, information on the locations of books that researchers, for example, need. This is the first bibliographic utility in Japan.

Type (2) which also involves drawings, photographs, and other image data, handles so much information (100 times more than character data) that conventional computer systems do not serve this purpose in capacity and transmission speed.

The Major four fields of office automation are (a) document building, (b) document copying, (c) document transmission, and (d) document storing and retrieving. The so-called "Electronic File"; a filling system utilizes optical disks, on the other hand, the conventional system is "micro-filling". As the information surrounding us has been getting more varied and more complicated, this newly developed electronic filling system has been getting more and more attention among people concerned.

Since the first entry on the market in 1982, the total of 1500 units of electronic filing system have been running so far in Japan. (as of the end of March, 1986)
The following are the three major merits of the system.

(1) small space for document filing, and smaller running cost

(2) immediate input, and high speed retrieving

(3) remote retrieving from far remote terminals

Particularly the features No. (2) and No. (3) are functions the conventional "micro file" does not have. It is natural that more and more attention should be forcused on them.

Practical application has been diversified in almost all industrial, medical, business and governmental filing transactions, such as specifiction of plan for industrial use, technical data, pattent information, resident registrations at government agencies, chart filing at hospitals, personal back-histories of employees, clients records, trends of market, information of technical development at general enterprises. So to speak, in every field the electronic file can be usefully applied.

Most of them are for local use, or in-house use, connected to a local area network (LAN). With the growth of digital communications networks and increasing speed, nationwide on-line retrieval systems are also increasing.

2. NECESSITY OF OPTICAL DISCS FOR STORAGE OF LARGE-SCALE DATA BASE

Figure 1 shows the memory hierarchy in an information processing system, and the position of optical discs in it. MSS (Mass Storage System) is a mechanical means which automatically selects recording media and loads them in the device.

Examples of it include an automatic warehouse system that automatically controls the existing magnetic tapes; one that uses broadcasting VTR tapes; one that uses special cartridges for recording media.

The conventional on-line data base systems use large-capacity magnetic discs or an MSS, while paper and microfilm data bases are handled off-line.

As the information-oriented society grows more sophisticated and intelligent, there will be more creative activities in a wider range of fields, which in turn will produce more and more documents, drawings, and charts. Retrieval will be difficult if the conventional way of file management, that is, management of paper and microfilm files, is retrained. Because image data are 100 times mocre voluminous than character data, optical discs that can hold more and store faster began to be employed.

How large the capacity of optical discs is, can be shown by the fact that a single optical disc 30 cm in diameter stores 60,000 pages of size A4 paper (4G bytes), equivalent to the storage capacity of 2,000 floppy discs. Figure 2 shows the recording capacities and access times of various types of memories[2]. Optical discs have other advantages. For example, optical discs are free from wear because of non-contact recording by means of laser beams, and store recorded information almost permanently.

3. OPTICAL DISC CLASSIFICATION AND TECHNOLOGY

Optical disc technology, an outgrowth of video disc technology, is about to claim its own position as a new kind of recording technology. Figure 3 shows the classification of optical disc memories. The first commercial video disc was introduced in 1981 as "a picture reproducing record", followed by the introduction of a commercial audio discs in 1982 as "a stylus-free record". Both originated in Japan.

Audio disc players are sold for less than 250 dollars and enjoy growing acceptance not only for portable use but for use in vehicles. A CD-ROM capable of digital recording was recently developed, and the market of electronic publications is expanding.

All the above are the read-only type. Write-once type optical discs for industrial use are generally called DRAW (Direct Read After Write) or WORM (Write Once Read Many) discs. Though they cannot be repeatedly written, such optical discs permit real-time recording and repeated reading. These advantages induced their use as large-capacity image files and computer back-up memories.

A few years from now, erasable type optical disc will be developed and put on the market, and will be used as the memory for computer and office automation equipment, meaning that conventional magnetic recording devices will be replaced with optical discs. Therefore, the ISO is speeding up its work on standardization of optical discs.

Figure 4 shows the theory of optical disc recording and reading. In an optical disc memory system, high recording density has been realized by utilizing a laser beam as a means of recording and retrieving. A laser beam, focussed into a 1μm diameter high energy density point on the disc through optics, makes a physical or an optical change whose size is in micron order on a storage medium. In reading, a lower power laser beam is irradiated on the disc.

By sensing the reflection, a change in the status on the recording medium can be detected optically. A recorded pit size is usually 0.8μm in width and 1μm in length. A track pitch is 1.6 - 2μm. this recording density is 50-100 times that for magnetic discs. Total storage capacity is 10^{10}-10^{11} bits in a 12 inch-diameter disc. The important factors of control technology are the focus servomechanism which focuses the laser beam on the recording layer through the optical disc substrate and the tracking servomechanism which follows the 1.6 um pitch recording tracks on the disc.

Generally, the disc substrate is made of DMMA or polycarbonate; the reflection layer of the read-only type is aluminum; the recording layer of the write-once type is tellurium. The erasable magneto-optic type mainly uses a combination of Tb, Co, and Fe. An enormous capital investment is necessary for optical disc production. Although electrical manufacturers have been producing both disc units and discs, material manufacturers will enter the media business to claim a share in their production.

Improved accuracy of media production and an advanced error correction system called Cross Interleave Read Solomon for disc drives were instrumental in reducing the optical disc bit error rate to less than 10^{-12}, making the optical disc competitive with magnetic discs.

4. Application of Large-Scale Data Base System Utilizing Optical Disc Memories

Application areas for document image files can be divided into two categories. One is where the amount of documents is very enormous, but where the kinds of them are restricted. Literature, patent journals or drawings fall in this category. In this case, their collection and classification are accomplished by a specific organization, working under a consistent concept. their classification hierarchy is usually made up beforehand, and once it is made up, it seldem needs to be altered. These files can be called "static files". For mechanization of such files, a mass storage means becomes of prime importance. Additionally, though storing documents can be carried out in batch operation, time for retrieval must be short, and highly efficient various retrieval requirements for many and unspecified persons.

The other category includes business office files. In this case, the amount of documents is less than in the former, but the kinds of documents and the ways to classify them are varied according to the work accomplished by the office. Additionally, with an increase in business or office organization, both the kinds of documents needed and their classification will change gradually. The more active the office is, the faster the change is. In this sense, these files can be called "dynamic files". For mechanization of such files, the following items are necessary.

1. Document images can be stored and referred to in real time.
2. Office workers themselves can make up their own documents classification hierarchy, according to the documents purposes in regard to the business.
3. The classification hierarchy can be grasped at a single glance, and documents can be filed very easily matching this classification.
4. The classification hierarchy can be altered very easily, as business requirements change.

It this way, different functions are required to document image files for various uses.

Followings are the typical system examples of Large-Scale Data Base which using Optical Disc Memories for image data file.

Figure 5 shows a photograph of a typical electronic filing system[3]. This system can do everything -- image input, recording, retrieval, display, and printout -- in real time. The component devices include an image scanner and a laser beam printer, which is similar to facsimile machine, a controller and display similar to those of a personal computer or word processor, and optical discs as large-capacity memories. Documents up to A3 in size can be handled. A single optical disc can store 60,000 size A4 pages. For document retrieving, many functions are prepared, such as multi-item logical retrieving, user-defined retrieving, page-to-page automatic retieving, which have been performed on the machine in the same way as

human behaviour in the office. There are many systems of this kind in service in Japan, used by manufacturers for technical data and drawings; by financial houses for agreements and real estate data, and by municipal offices for resident cards and seal impression certificates.

Figure 6 shows a system linked to an existing computer and facsimile machine. The existing character data base on-line retrieval system is configured with optical discs to meet the new need for an image data with optical discs to meet the new need for an image data base of drawings, photographs, etc. Document image data retrieved by on-line retrieval terminals can be automatically output via the facsimile machine that is connected to the system. It is the most economical system at present.
There are may examples, including one in the Tokyo Metropolitan Government building which provides open information retrieval services for Tokyo cities, and one at a pharmaceutical manufacturer's for on-line retrieval of enormous amounts of test data.

The example shown in figure 7 is a high-speed image retrieval system utilizing a special communications network. The system uses a 100M bps local area network (LAN) for in-house communication, and a digital data communications network (DDX) of a few megabits per second for wide-area communication. An image transmission that takes 1 minute

through a facsimile network is done in a few seconds by this system. Examples of this sytem in service include the retrieval system for patent examination in the Patent Office; the equipment-drawing on-line retrieval system used by a steel manufacturer, and the certificate on-line retrieval system of an insurance company.

5. SUMMARY

Optical discs have a history of only five years, which is much shorter than the history of 20 years of magnetic discs. This short history gives us greater hopes for technological progress in the future: advanced recording media resulting from the development of new materials by material manufacturers; semiconductor lasers of higher output power and LSIs of higher densityby semiconductor manufacturers; smaller and lighter optical parts by camera and lens manufacturers; standardization of recording formats and system interfaces. Technological progress involving all of these can be achieved by the coordination and cooperation of office automation system manufacturers, computer companies, and other industrial sectors.

Optical discs follow a course of development similar to that of magnetic discs or floppy discs -- 12", 8", 5.25", and 3.5". A super large-capacity memory system, such as an optical disc automatic changer of a few hundred G bytes, which corresponds to magnetic tape MSS, is being developed. On the other hand, a laser card was developed as a portable optical memory. This paves the way to structuring a data base hierarchy involving personal data bases, distributed data bases, and centralized, large-scale data bases.

Work stations that combine the functions of a present office automation personnal computer, word processor, and image processor will emerge as data base on-line retrieval terminals. Application of knowledge engineering technology to terminals will enable more visual, simpler retrieval operation, and raise system cost performance.

Optical fiber cables forming such networks as LAN and INS speed up the operation of on-line retrieval systems and enable the handling of large volumes of information, including composite information (code data, image data, graphic data, etc.).

As described, aplied optical technology involving optical discs as large-capacity memories, optical fiber cables, as high-speed communication media, and optical printers, will be increasingly important in structuring large-scale data base systems.

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(3) R. Yamaguchi "Electrical Filing System": Toshiba Review 1983, Vol. 38, No.6, P.498 - P.503

(4) K. Izawa "Document Image Filling System utilizing Optical Disc Memories": IEEE Data base Engineering 1984, Sept.

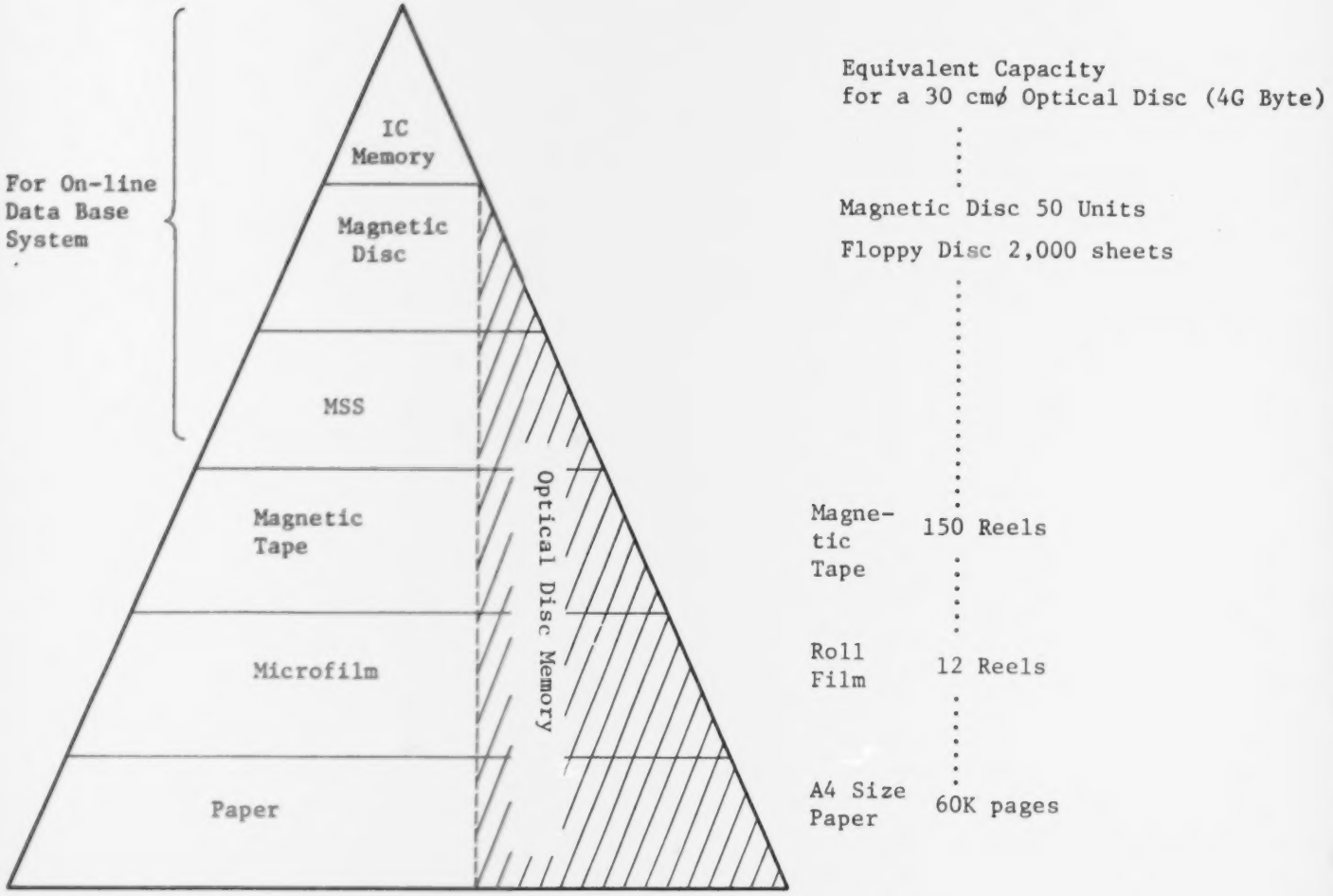

Fig. 1 Memory Hierachy in Information Processing Systems

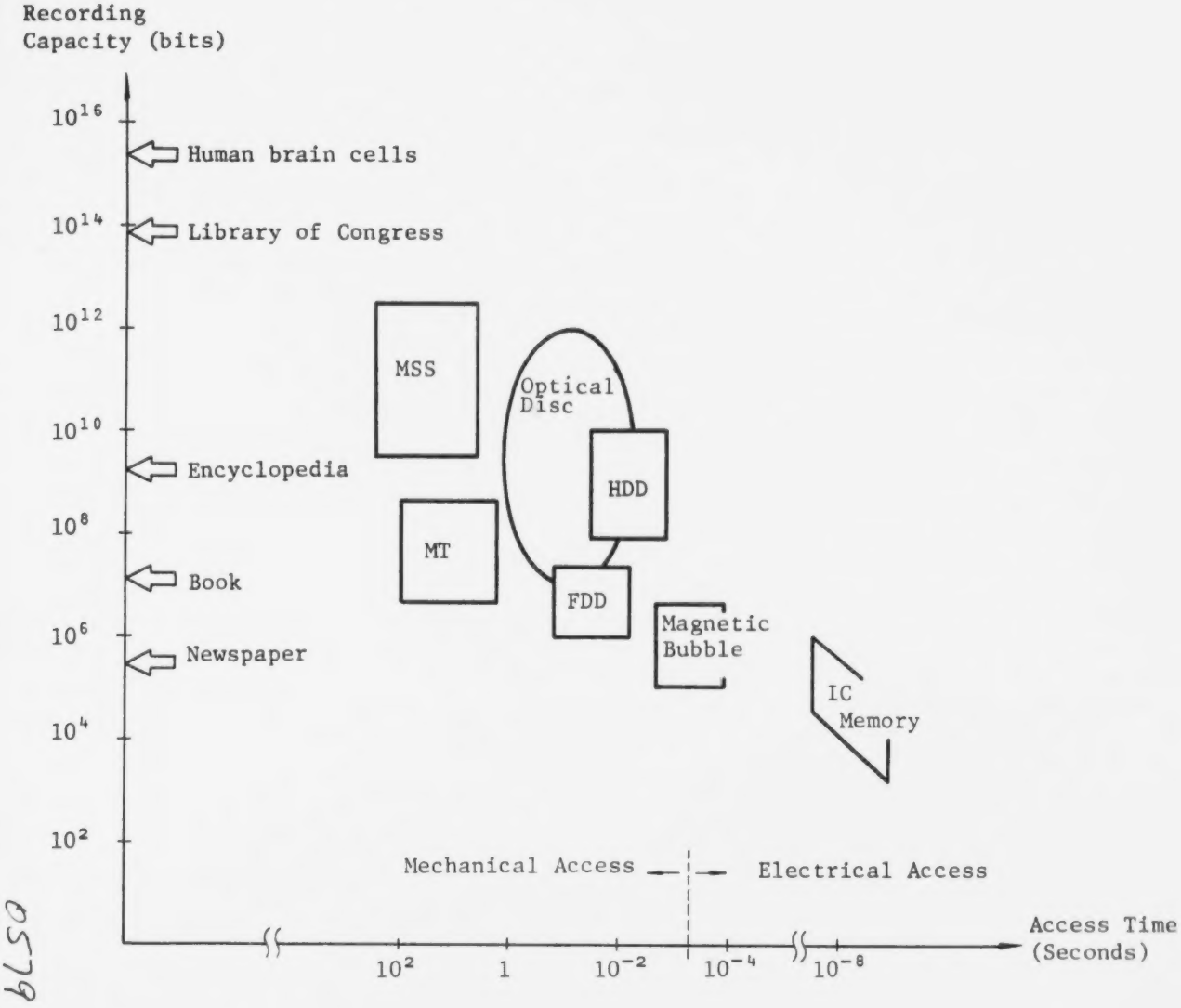

Fig. 2 Recording Capacity vs Access Time of Memories

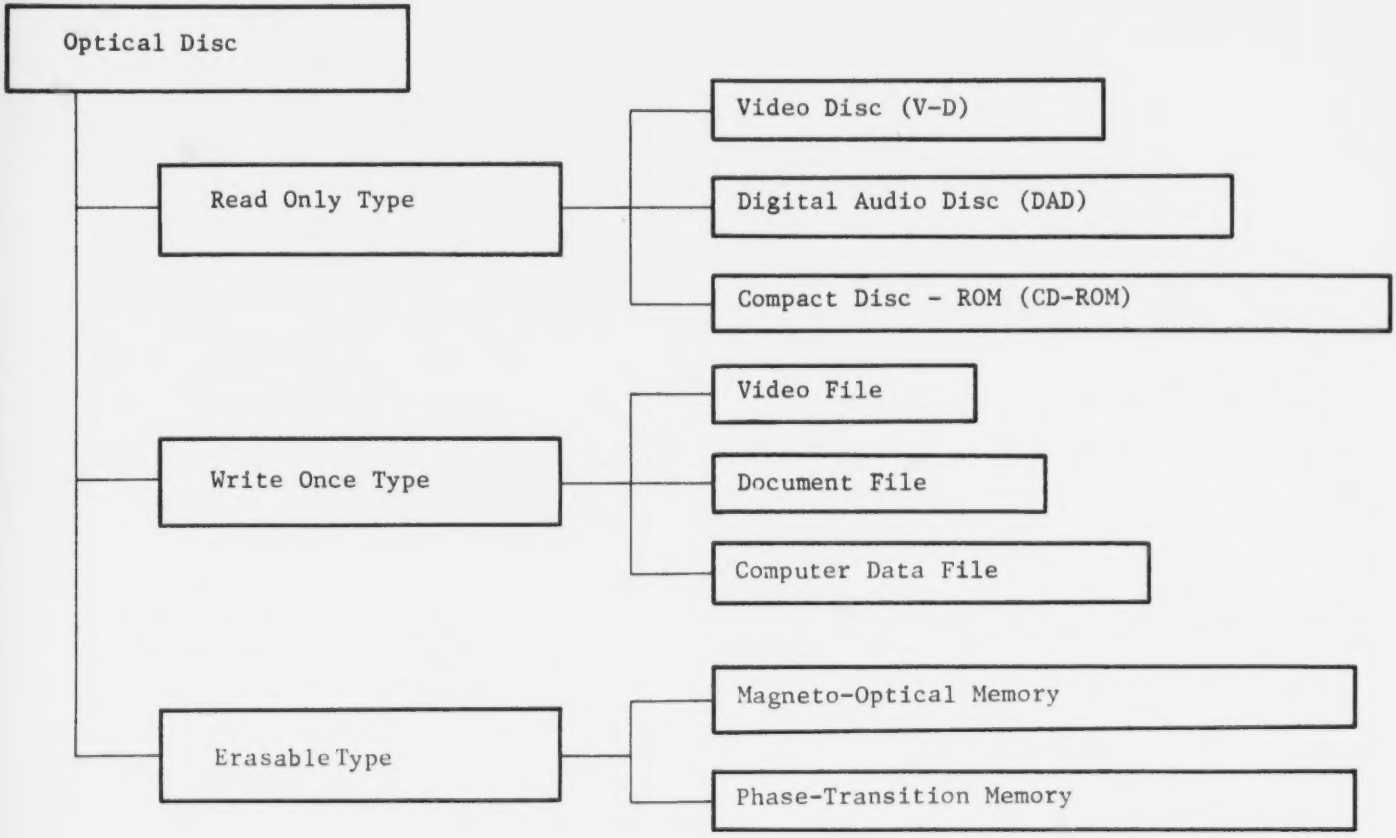

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Fig. 3 Classification of Optical Disc Memories

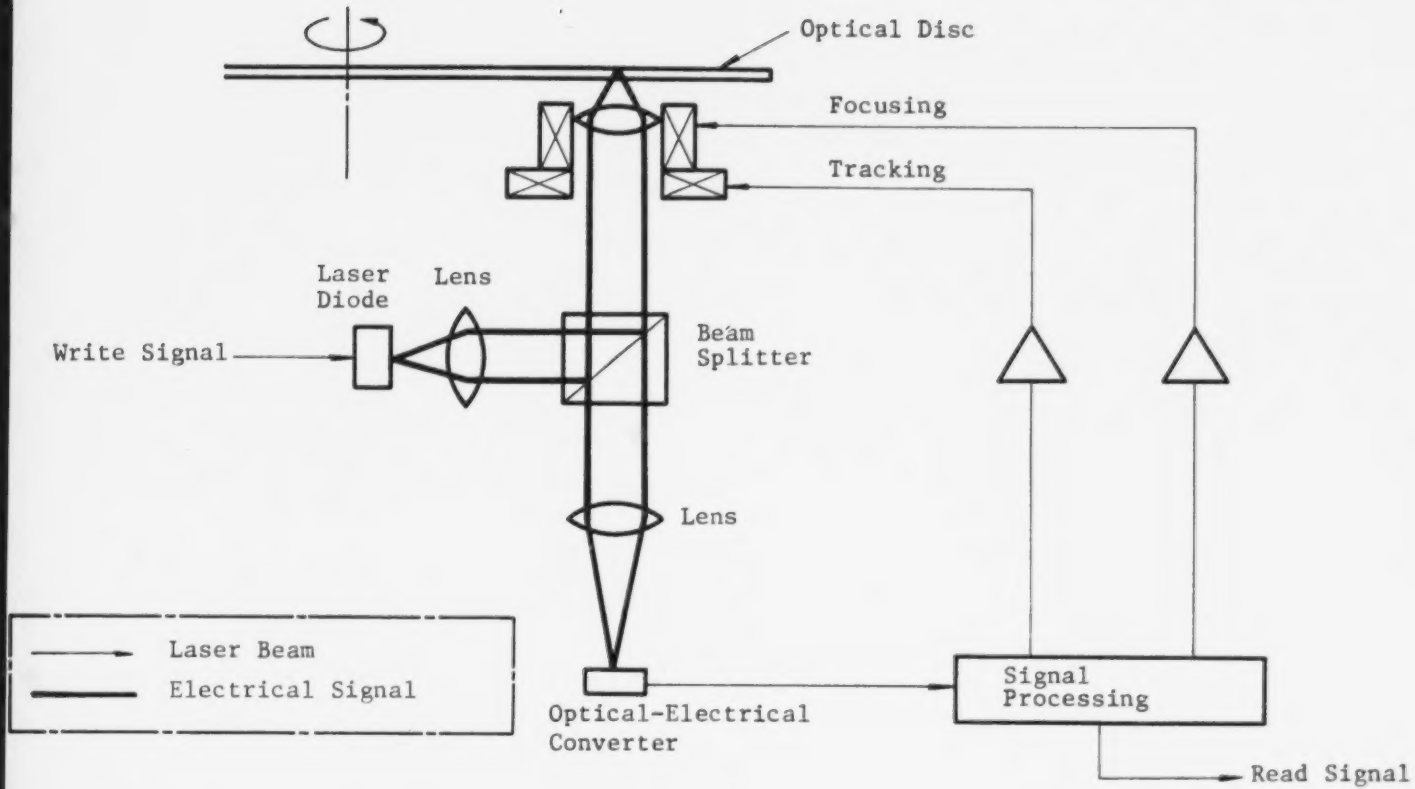

Fig. 4 Read/Write Principle of Optical Disc

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Fig. 5 Picture of Electronic File (DF-3200H)

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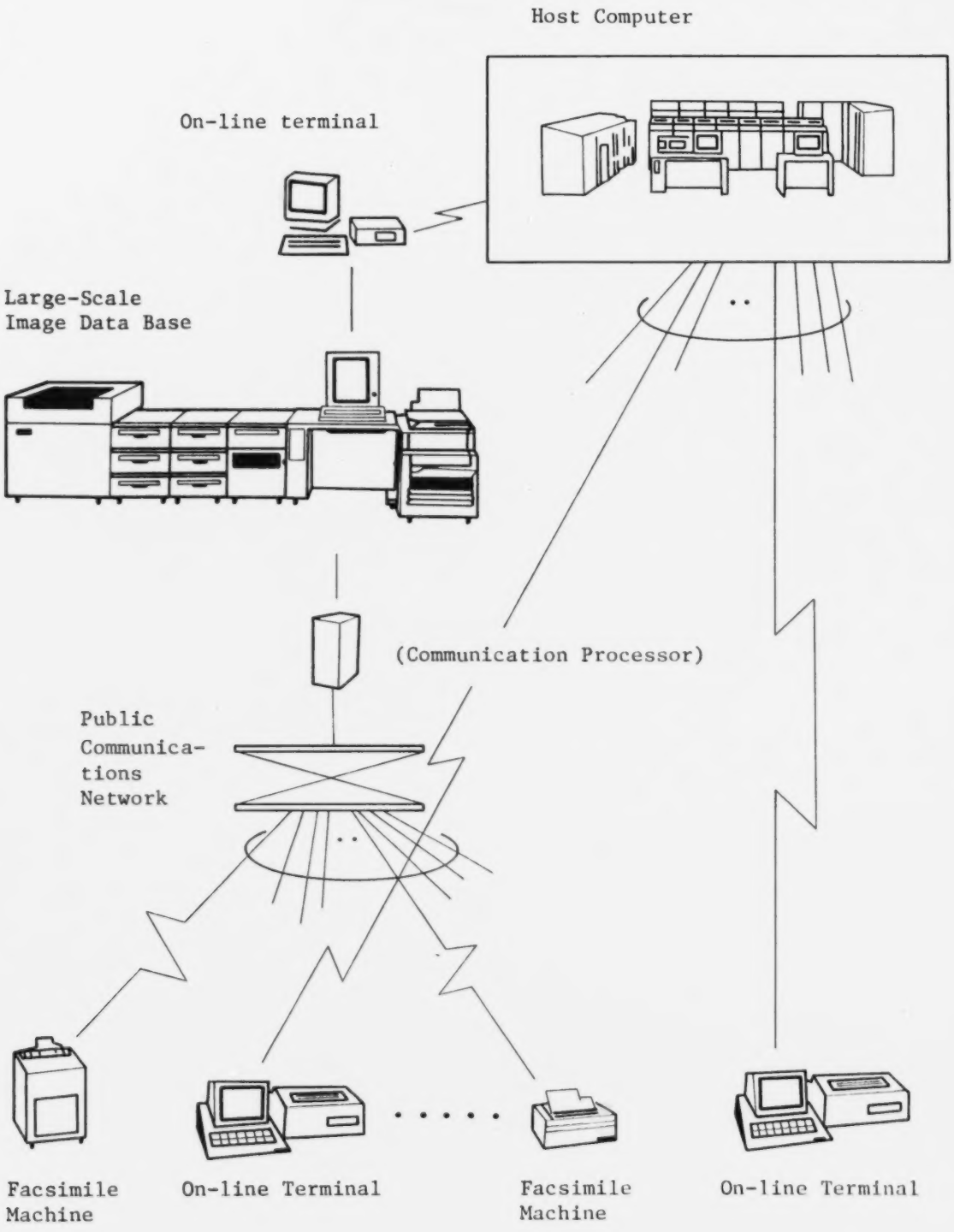

Fig. 6 On-line Image Retrieval System

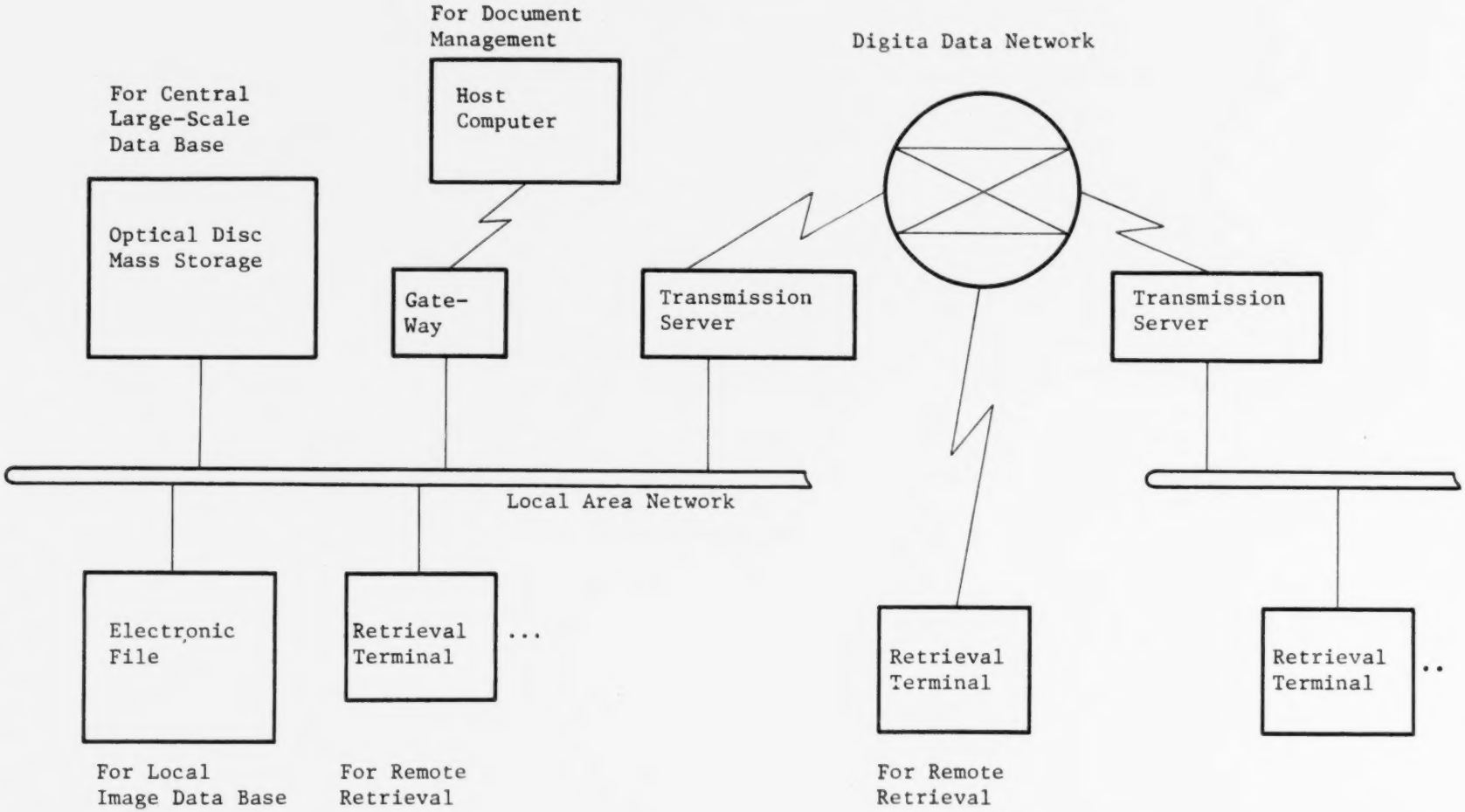

Fig. 7 High Speed On-line Network System

IFLA 1986

IFLA GENERAL CONFERENCE, TOKYO

Division: Management and technology

Section: Information Technology

215-INF-3-E

REPORT on the IFLA Pre- Conference Seminar on Automated Systems for Access to Multi-Lingual a and Multi-Script Library Materials : problems and solutions, Nihon Daigaku Kaikan, Tokyo, August 21st - 22nd, 1986

Presented to the Open session of the Section on Tuesday 26th August by Stephen W.Massil (University of London, U.K.)

KEYWORD(S):

Library Automation

Conference
Multi-script

Bibliographic data bases
Standardisation

For internal use only: SI

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Remarks:

to be presented orally ☒

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REPORT on the IFLA Pre-Conference Seminar on Automated Systems for Access to Multi-lingual and Multi-script Library Materials : problems and solutions, Nihon Daigaku Kaikan, Tokyo, August 21st - 22nd, 1986

presented to the Open Session of the Section on Information Technology on Tuesday 26th August, 1986 by Stephen W. Massil

The Pre-Conference was jointly organised by the IFLA Section on Library Services to Multicultural populations and the Section on Information Technology in collaboration with a local organisin committee in Tokyo under the chairmanship of Hiroshi Tanabe. The parties all met in Chicago last year and its organisation was a truly international affair with co-ordination between members in Ottawa, London, Frankfurt and Tokyo; the smoothness of operations was due very largely to the work of Natsuko Furuya of UTLAS, Toronto acting as co-ordinator with the local organising committee and then as Moderator at the pre-conference sessions themselves. There was a very large attendance in Tokyo, primarily of Japanese participants; it had been hoped that more North American and European participation would have been forthcoming and it is a matter of some regret that Southeast Asia was not better represented. Thirteen papers of substance were presented and I shall be indication the scope and chief points of these. It is intended to publish the proceedings as soon as possible (by Saur, in the IFLA conference series) and this report is by way of an interim account until publication. But I hope that both IFLA Sections involved and others interested in the theme and the implications of the current situation as it now appears, will take note of the comments and will go forward with them.
The Local Organising Committee have just completed their report on activities and I understand that a surplus of some ¥90,000 has accumulated after sponsorship etc and that a formal presentation to IFLA will be made at the closing ceremony this week.

The idea for the Pre-Conference grew initially with the Section on Library Services to Multicultuarl Populations whose membership is acutely aware of the problems of providing adequate catalogues of materials in different scripts, in public libraries especially. And whereas in manual cataloguing there are great problems for transcription, transliteration, authority headings and filing, these are compounded in the automated environment by the machine problems and questions of characetr sets, standards, display, and the desire to share records from a data base. The opportunity offered by the IFLA General Conference in Japan and the interest of the Section on Information Technology, concerned as it is with automation, standards and the infra-structures of UBC, data bases and exchange of records, made it easy to trans-

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late the need for an intensive review of the situation regarding automation of non-Roman scripts into the reality of a programme and a conference on the subject.
A comprehensive bibliography (1) of recent work on the subject was produced in time for the conference and it shows the intensity of interest and investigation in many parts of the world.
Implicit in the programme of the Conference is the concern with non-Roman scripts but one could perhaps begin by referring to the problems of automating Roman alphabet character-sets which comprise more than just the 26 letters used in normal English writing. It was pointed out at the conference that the extended Roman character-set necessary for a comprehensive but normal bibliographic environment is 179 characters in the current standard - and as even many libraries in the West have known automated systems have been launched where not all these have been available and a variety of substitutions, omissions and deficiencies have had to be tolerated; not least, the display of upper case characters in outputs prior to the installation of capable printers etc.

The conference papers certainly presented the problems of handling non-Roman materials from many points of view, and in some cases they showed solutions for particular environments. I am not going to say that the conference came up with full solutions to the problems as such, but it clarified the issues at a time one can say that the options in some quarters (where large-scale commitment of resources and development of systems are now becoming firm) are becoming fewer and restricted by virtue of the commitments already made. Of concern to IFLA must be the differences between solutions proposed, and the wish to assist libraries and services in areas where the imbalance of world development carries this additional feature of local scripts faced by the problems addressed by this conference. The fact of character-sets in a country like Korea or Burma or Thailand and of the many languages of India has a bearing on commercial computer developments in those countries - standards applied (if any) depend more on the computer firms than on appropriate cultural agencies where libraries and the international standards that they might wish to follow can be properly given a hearing.

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(1) Automating non-Roman scripts / compiled by Sylva Simsova and John Clews. - Harrogate: Sesame, 1986. - 35p

The Papers

The paper on 'Romanized and transliterated databases of Asian language materials : history, problems and prospects" by Suzine Har-Nicolescu (City University of New York) opened the proceedings with an overview of the background to the problem as seen in the West. Transliteration at least of headings has long been a tradition of western cataloguing which the early stages of automation has entrenched more strongly for the moment* and the paper reviewed the grounds for considering transliteration an inadequat solution both in the West and certainly in the countries using the scripts in question. Mrs Nicolescu gave the first of several analyses of the East Asian scripts. She set out some cogent point on the processes of UBC and the ISBD in coming up with standards that do not adequately take account of specific Asian language requirements. She makes a plea for a redrafting of the ISBD with the needs of other scripts in mind and proposes much greater co-operation in Asia in the creation of networks; she suggests a role for IFLA in co-ordinating developments with scripts and coding, and in opportunities for review of developments in Asia and amongst western practitioners.

Alan Tucker of RLG gave the second introductory paper on 'Non-Roman and multiscript bibliographic databases : basic issues and implementation', and this reviewed the techniques needed for implementing multiscript data bases setting out the problems to be faced and some guidelines for their solution.

Following the introductory papers we had a series of more specific papers related to different countries or different languages and scripts.

Firstly a paper by Shojiro Maruyama (National Diet Library) on 'Bibliographic control and library automation in Japan'. This provided a useful survey of bibliographical control in Japan and of cataloguing practices and automation developments including the stages of development of the Japan/MARC format and data base. It examines the role of the Japan Institute for Standards (JIS) in the formulation of a standards for character sets. It set the scene for a subsequent paper on character-sets in Japan and it proposes further action both nationally and in the East Asian area where a Kanji version of UNIMARC is needed.

The next paper came form Taiwan and was presented by Jack Huang on behalf of the Chinese Character Analysis Group entitled 'An universal coding system for a multi-lingual environment'. The paper is a detailed technical account of one approach to the solution of coding Chinese characters, the Chinese Character Code for Information (CCII) implemented initially in 1983;

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*What we did not get through the papers although it emerged in discussion, is that the traditional recourse of East Asian libraries in handling foreign language/foreign script materials is not transliteration but translation, an equally misleading proposition, but suitable in the context of information retrieval.

and further versions have been developed extending the range of characters substantially each time. It is a standard related to ISO 646 and 2022, and to JIS C6226, and is seen as the basis for integrating different coding systems under one standard without the need for systems modification, and for the interchange of the different East Asian character-sets. The 4th version of the standard due in 1987 will exceed 70,000 characters and its structure will be invaluable for developing multi-lingual software for the next generation. Hardware to handle CCII is already being developed and both hosts and PCs are expected to be on the (Taiwa market in the near future. Mr Huang raises several difficult questions of the logic of codings and the requirement of automatic handling of characters and their substitution in input/output relations.

Less technical and more expressive of the problems of establishin standards was the third paper in the series. This was from Professor Kyu-Seob Hyeon (Kongju National Teachers College, Korea) on 'Establishing the standard character code system for Korea and its application to the Korean MARC data base'. While there is a Korean standard KIS 5619 for Chinese charcaters it covers far to limited range for bibliographic purposes. The Central National Library in developing the KOR MARC system has had therefore to develop its own coding for Chinese characters. It has also had to maintain separate files for different languages and scripts. Professor Hyeon sees the need for a mutually recognised East Asia standard for character coding as a matter of great urgency; and he believes it is needed if only to give libraries in Korea more weight in their negotiations with computer manufacturers who are inclined to impose their own codings disregarding even such stand ards as there are.

The final paper in this set was by Edward Lim (Universit Sains Malaysia) on 'Computer processing of Southeast Asian scripts, with particular reference to Jawi and Thai'. By concentrating on two scripts Mr Lim succeeded in illuminating the problems of computerising the range of alphabetic scripts (as opposed to ideo grams) where the mapping of character-sets to ASCII or EBCDIC entails no insurmountable problems. There remian with various scripts specific complications and the fact that imported hardware and systems developed early on have taken easy options when tackling the problems thus leaving an uneasy situation as new requirements are brought to bear. Automation of Thai for instance was achieved fairly early in the late 1960s and 1970s but at the expense of full solutions to the problems. Just as early applications in North America settled for uppercase Roman because printers were not available to display lowercase, automation of Thai is still left at its initial implementation without opportunities for change because the residual problems

(crucial in bibliographic terms) are not serious (to the supplier) in other respects. The problem as Mr Lim concludes, is not in the character-sets but in persuading suppliers to design systems for which there is a limited market.

We began the second day with a paper by Dr Mohammed Aman (University of Wisconsin-Milwaukee) on 'Use of Arabic script in computerised information systems'. This took the examination of Arabic into great detail, and while this inevitably carried over from Mr Lim's comments on Jawi, it introduced new elements into the wider discussion. It made reference to the Arabic standardisation system (and character standard 449-1982 in particular) and the desire for Arabic libraries to have 'Arabised' versions of international standards and software. Dr Aman could record some of the successes in this respect as well as the problems that remain.

Dr Aman was followed by Eve Stocker of Technilib (Melbourne). Her paper on 'Development of the Greek automated cataloguing system in Victoria, Australia' arises precisely out of the inspiration for the conference on the part of the section on Library Services to Multicultural Populations and makes a useful case study in the proceedings. It also recounts public library activity in this area and shows a fruitful development between the libraries concerned, systems suppliers and hardware suppliers. And just as Mr Maruyama and Dr Aman relate the problems of character coding to the bibliographic environment as a whole, Mrs Stocker illuminates the administrative aspects of cataloguing in Greek in a multilingual environment. The question of wider reference opened by this paper is what bearing can such a local development have on MARC cataloguing in Greece itself. Can the approach taken by the Victorian libraries be accepted by Greek bibliographic agencies only now just beginning to look at the need for MARC in Greek developments? Similarly, can the problems of Jawi in the Southeast Asian context be assisted by solutions being pursued in the metropolitan Arab countries?

The next paper was given by Akira Miyazawa of the National Center for Science Information Systems (Tokyo) on 'Character set and its control in an online cataloguing system : applications at the (Japanese) Center for Bibliographic Information (CBI). Mr. Miyazawa drew us back to the Japanese character range and the problems of multiscript processing; he describes the CBI's bibliographic utility system for Japanes university libraries which in our specific area includes support for both ALA and Kanji character sets and uses a workstation specially designed for the purpose; the system includes Kana conversion. - I suppose that this is the point to mention that the Pre-Conference enjoyed the support of several Japanese computer and publishing firms, and that their products, workstations and library computer systems are on

show at the Conference Exhibition this week where the variety of equipment testifies to the range of developments but also to the need for standards.

Mr Miyazawa covered the more technical aspects of coding and controlling the Japanese character sets left out of Mr Maruyama's presentation. He adds the point that the CBI cannot cope yet with Chinese and has great difficulty with Cyrillic, having to resort to measures imposed by the hardware for the time-being.

As befits for a host country, there was athird paper on Japanese applications in the form of Jack Cain's paper on 'UTLAS developments with Japanese and Chinese scripts' in which he described the UTLAS online cataloguing system as redesigned to fit the Japanese academic scene. The point was made that Japanese users of the UTLAS non-East Asian data base would need to access it in Toronto and likewise North American users wishing to access the East Asia data base would need to access Tokyo.

This was preceded by Mr Haeger's paper on 'CJK enhancements to the RLIN system : a review of basic issues' so we had two more approaches to the question of handling East Asian materials from different perspectives and a useful discussion ensued which was ably mediated by Mrs Furuya having to give a succession of questions and answers back and forth in English and Japanese.

The final paper was by Cynthia Durance (National Library of Canada, Ottawa), 'What next? issues arising from the conference deliberations" and I could have read you her paper in summary but I have cast this presentation more as that of a reviewer than as a participant. Miss Durance also appends a very useful summary of the status of the chief ISO standards on character sets. She summarises the proceedings as follows:

> The major issues include the need for increased awareness that automated soultions for Roman-language data bases are not always applicable to other languages. It is recognised that lack of international standard transliteration schemes and coded character sets for many languages are major barrie to their automation, even though technological advances are increasing the ability to manipulate ideographic and non-Roman alphabetic data. IFLA can advise on and assist efforts to automate these languages and thereby help achieve its goal of Universal Bibliographic Control.

Other Papers

Before coming to my concluding remarks I should add that to be included in the proceedings is a paper by Sylva Simsova and John Clews (UK): 'Computers in a multi-script library environment'. The paper was circulated in the Pre-Conference package and it is the authors' bibliography that I have already referred to. Like Mrs Stocker's paper their work arises in part from direct investigation of providing cataloguing for South Indian materials (not other-

wise referred to in the proceedings) but also tackles the question transliteration and of computer systems, coding hardware from a more practical point of view than Mr Tucker.

There were also short contributions on MINISIS by Mike Sherwood of the IDRC (Singapore) and on the problems of an area studies cataloguer by Mr Chan of the Australian National University. The IDRC development of MINISIS offers some tabgible solutions to the problems of multiscript systems designers and is of interest to this Section as a further reference to our review of portable systems first presented at Nairobi.

Conclusion

As I have said, the proceedings did not deal with all scripts and languages - we did not hear about Cyrillic except indirectly from Japan, nor from Israel where the multiscript situation at the National Library with Hebrew and Yiddish, Cyrillic and Arabic as well as Roman alphabet processing must make an interesting concentration; nor did we have contributions from China itself (and this was a disappointment) although a paper from Taipei was included a as I have described. It is sufficiently clear from the discussion on the East Asian languages, on Arabic and Greek in a 'minority' context, Jawi and Thai, that the problems are of the same kind with any script and are of the same order when the implementation of automated systems comes up against a lack of standards, availability of a narrow range or only a single type of computer hardware and where library activities take a back seat so far as computer developments are concerned.

On reviewing these papers one can say that each arises out of its context so that we have a fascinating counterpoint on the East Asian material especially of the different perspectives taken. In North America, Europe and Australia academic collection of materials for 'area studies' comprise large amounts of East Asian. Islamic or South and Southeast Asian materials, all predominantly in non-Roman scripts butmatched by materials in European languages. The papers from North America present work on the automation of CJK in particular from this point of view, requiring an integrated catalogue of Roman and non-Roman materials. On the other hand, papers from Japan, Korea and the Chinese setting take the standpoint of automating the national bibliographic output in the national script with reference to coding problems and attempt to create national standards and in fact, regional standards. (In passing one should say that just as Greek characters have become part of the extended Roman character-set, so some Roman character used in MARC collation fields are now part of the extended Japane and Korean extended character-sets).

This situation has a bearing on UBC. The fact for example, of Southeast Asian collections in western librariues and the efficiency of acquisition and bibliographic systems to handle them could be

the theme of another IFLA pre-conference seeing that these collections are likely to be fuller and beeter catalogued than indigenous collections. The aim of UBC however, would be the generation of indigenous national bibliography and of MARC exchange services that the western libraries would use - instead they now create their own cataloguing for the material. In the context of the CJK project (and new developments at OCLC also to be viewed at the Conference exhibition) and the JApan MARC data bases, we have the likely situation that duplicate MARC cataloguing is now going on. The options, as one participant noted, are narrowing - the problem of relating to a common standard for coding and sharing records is now acute if we want to eliminate the duplication. In the North American context this because systems are hardening in their design; and in East Asia because systems to handle the local scripts are multiplying without attention to common standards. And the suggestion of one participant, that there should be a 'superstandard' for coding characters in Chinese, Japanese and Korean did not find much favour. Its intention would be the creation of a coding system to which all could relate their local systems of coding but without interfacing the local systems. It was generally agreed that the cost of building and maintaining data base interfaces is greater in operation than the initial costs and operation of established common standards.

Summary

Firstly, to recap, let me set out some of the specific problems of the scripts and why progress is complicated in the present state of automated bibliography:

Accommodation of the extended character set (e.g. Arabic) to ASCII or EBCDIC coding;

Problem of alphabets with letters in different forms;
Direction of printing;

Mixed script output;

The order of filing of characters;

Problems in languages where information strings do not need to be broken word-by-word;

Desire for calligraphic presentation

Now to summarise the chief areas of concern expressed both in the papers and by participants:

The question of standards is seen to be paramount; this will entail further work nationally as well as a further examination of the international and UBC standards as they are at present set out;

The problems for bibliographic agencies (both the libraries themselves, and those providing computer services to libraries) in relation to computer developments that fail to take library

requirements into proper account;

Of concern is the advanced stage of some developments both in Japan and North America that seem not to have practical cognisance of each other. There is a need for a mechanism to relate North American developments, requirements and achievements to those of East Asia. It is for IFLA to discuss whether this is necessary - what is lost by a lack of dialogue between CJK, CCII and Japanese developments? What benefits will there be by practical standardisation between East and West on this?

Mr Lim in his paper was optimistic on the computer side; MINISIS would seem to offer an immediate starting point for small-scale operations; Mrs Nicolescu in a phrase echoed by Miss Durance believes that a nation's information systems and services can co-incide with those of regional and global information systems and services. As you have just heard by my questions to IFLA, I am more pessimistic.

Postscript

Since the Pre-Conference did not have time or the intention to formulate specific resolutions, I hope that in setting these points out in a formal conclusion, the respective Standing Committees of the Sections involved will take up those most appropriate to their deliberations and their Medium-Term Plans. This should be a positive way of tackling the problems perceived by the Pre-Conference so as to channel attention to them through IFLA and the work of the UBC Core Programme.

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IFLA GENERAL CONFERENCE TOKYO 1986

Division: Management and Technology

Section: Information Technology

202-INF-2-E

The Australian Bibliographic Network

by

Warren HORTON

Director-General

National Library of Australia

CANBERRA ACT Australia

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THE AUSTRALIAN BIBLIOGRAPHIC NETWORK

Warren HORTON

Director-General, National Library of Australia

The Australian Bibliographic Network (ABN) is a national online bibliographic facility based on co-operative participation. It has participants in every State and Territory of Australia, and provides services to libraries of all types. Its membership includes State, university, college, public and special libraries as well as the National Library.

The primary function of ABN is shared cataloguing: to eliminate the duplication of original cataloguing, the time consuming and costly operation, by allowing the cataloguing of any participant to be shared immediately with and copied by any other participant. ABN also provides enquiry, bibliographic verification and library location services and has the potential to support a wide range of other library services. Because the system has been designed to perform multiple functions, further subsystems such as acquisitions or inter library loan request systems can be added when available resources permit and demand justifies.

ABN became an operational system within the National Library on 31 March 1980, and a publicly available service on 2 November 1981. Its membership now includes most of the major libraries in Australia, with over 115 full participants

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and nearly 400 dial-up customers. The latter members "inquire" for information from the system, but do not directly use its cataloguing services. It is expected that the number of records on the bibliographic file by the end of 1985/86 will be over 4 million, with approximately 2 million titles having holding statements and about 2.30 holding statements on average per title. The ABN authority file contains approximately 600,000 records. The ABN income for that year is budgeted at c.$3.6m. Some idea of the size of the system can also be see from its products: it will in 1985/86 produce over 500 fiche catalogues, over 600 magnetic tapes, over 600,000 catalogue cards and c. 2,000 new title lists for its customers.

Government approval to establish ABN in 1981 was a culmination of more than 15 years of development in the provision of bibliographic services to the nation by the National Library of Australia. A national seminar on central cataloguing in 1966 for example urged the National Library to set up central cataloguing services, and it was the subsequent establishment by the Library of the Australian Card Service in 1967 which led eventually to ABN. The National Library Council had by 1972 recognised the need for the development of more sophisticated national bibliographic services than the Card Service and the Australian MARC Record Service, and in 1975 a study team was formed "to examine and report on the feasibility and likely cost of a national bibliographic support system".

The Library published BIBDATA Network, which was a draft proposal for an Australian national shared cataloguing system, in 1976 but this scheme was fairly roundly criticized on grounds of over centralisation and undue cost. However support for the aims and objectives of the projected service was clear, and the Library therefore proceeded to survey systems throughout the world in search for one which might reduce the capital cost of establishing the network while at the same time allowing for online operation. By February 1980 the Library had negotiated a licence to operate the Washington Library Network software in Australia to meet its own needs and possibly those of the national system. The key to the establishment of ABN was the publication of a Draft proposal for the development of an Australian Bibliographic Network, in early 1981, which was then systematically discussed by the Library with the library community in a series of consultations throughout Australia. The expressions of support from the library community were so encouraging that Government approval was sought in the Estimates for the 1981-82 financial year.

Unfortunately this submission coincided with Government decisions to limit public sector expenditure, and the approval for ABN was qualified by the statement that it must be established "within the Library's Appropriation" and subject to recovering all costs. The measure of importance that the Library attached to ABN can be seen in the decision to nonetheless proceed with its establishment, and it has had the highest priority in National Library services since that date.

The ABN system is based on software developed for WLN, which operates in the Pacific Northwest region of the United States. The complete software system consists of over 400 applications programs (representing more than 500,000 lines of code), the ADABAS database management system and the CICS teleprocessing monitor. The applications programs, mostly written in PL/I with some Assembler routines, consist of three online sub-systems - Inquiry, Input/Edit and Acquisitions - and a batch products sub-system, as well as a large number of ancillary programs. The Acquisitions sub-system has not yet been implemented in the ABN system.

The ADABAS database consists of five main user files - Bibliographic (containing pseudo-MARC records), Vocabulary (containing name and subject authority records), Key (containing keywords from bibliographic and vocabulary records), Holdings (containing call numbers and other information relating to items held by participants) and Working (containing records input online by participants and those records subject to review). Added to these are systems files and internal indexes maintained by ADABAS.

ABN is operated centrally from the National Library's computer with leased line and dial-up connection to institutions in all Australian States and Territories. The basic hardware configuration is:

- FACOM M200 CPU with 12 MB of main store
- Storage technology disc drives (18GB)
- 8 x F613 tape drives (800/1600/6250 bpi)
- F2806G communications controller
- F650D line printer
- IBM 3203-5 line printer

Within the National Library, there are 130 local terminals connected to the CPU through a multiplexor channel, 100 of which are dedicated to ABN use. In addition, there are more than 350 remote terminals in other institutions throughout the country which operate via leased lines connected to the computer through the F2806G communications controller. All of these terminals (local and remote) are IBM 3270-compatible devices and are supplied by FACOM, Ericsson, Raytheon and AWA/Telex. There are also a number of computer systems which communicate with ABN in IBM 3270 mode. These include DEC VAZ 11/780, AWA Sequel and a network of IBM and FACOM mainframe computers in the Northern Territory. Leased line communication employs Fujitsu Network Architecture (FNA) and Binary-synchronous protocols, although this latter type is being phased out. The Network makes extensive use of Telecom's DDS and Datel facilities, with Datel also being phased out.

The Library expects to shortly receive Government approval for the lease of a new computer, which will provide increased central processing capacity.

What I would like to do in the latter part of this paper is speak about some of the issues facing ABN in its further development. The first is the question of governance of the Network.

It was accepted at the time ABN was established that its national importance required the establishment of effective and ongoing mechanisms for consultation with its participants about policy and operational matters. On the other hand, because of the conditions applied to the establishment of ABN and the dedication of substantial resources of National Library funds, staff and equipment, the Library clearly had to retain administrative control over the enterprise. The solution to this dilemma was the immediate establishment of two committees, the Network Committee and the Standards Committee, which while only advisory were intended from the first to exercise as much actual control as possible over the Network, its development and its policies. The then Director-General, Mr Harrison Bryan, made it clear that in the Library's view it should be guided by the Australian library community whose interests it was serving by the development of this bibliographic network.

The terms of reference for the Network Committee state that it will advise the Director-General of the National Library on all aspects of the operation of ABN, including establishment, development of policies and forward planning,

relations with user groups, charges and budget and the regular review of operations and progress. It is a testament to the commitment of the National Library to consultation with ABN users that a Director-General has yet to refuse to accept a recommendation of the Network Committee. I was a member of that committee from its inception in 1981, as the nominee of the Australian Libraries and Information Council, until my appointment as Director-General in succession to Mr Bryan in July, 1985. His decision to establish this consultative mechanism is in my view one of the main reasons that ABN has been so successful in the Australian context. Both the Network Committee and the Standards Committee have a strong element of elected members in their composition.

Nonetheless I believe there are now some tensions insofar as governance and operations of the Network are concerned. One of the reasons for this is the growth of "customer" members, who have no direct representation on the Network Committee nor guaranteed voice in the governance of ABN. The Library and the Network Committee have both accepted in recent months that the time is now appropriate for an open ended review of governance mechanisms, but if any changes are made I have no doubt they will build upon the present strong emphasis on consultation and representation from users of the Network.

In a second interesting development the Library in 1984 accepted the concept of a National Bibliographic Database, as a direct operational and financial responsibility of the

National Library. We are now moving to consolidate the services we operate from the National Bibliographic Database, so that ABN, the Australian MARC Records Service and the Australian Card Services will all come from it. We have been delighted at the understanding the library community has displayed as to why we wanted to do this, and the recognition of the overall opportunities of shared resources that it offers. We have been pleased by the acceptance of a new charging schedule to operate from July 1986, which encourages "customers" to contribute holding statements for material in their collections, and the recognition of the desirability of allowing and encouraging a wider group of libraries to do this so as to enhance its use as a union catalogue. The Library, and indeed the Australian library community, is committed to aggressively further developing ABN and the NBDB as the vehicles for wider library co-operation, and the impending introduction of an interlibrary loan module with recent concurrent agreements on electronic messaging systems for national services exemplify the wider options for effective sharing of the nation's resources that are now being actively explored.

Nonetheless the Library has had considerable resource difficulties in further developing ABN, and in particular has now reached full cost recovery but not achieved Government approval for devoting surplus profits to the further development of the Network. There is considerable and in some ways justified resentment from some participants to the fact that ABN's operation with the Australian Public Service imposes

quite significant overheads on the Network, and while appreciating the fore- bearance of our customers we recognise that we must solve our resource problems as a matter of urgency or risk significant haemorrhage to the membership of the Network and a consequent diminution of its national resource sharing capabilities.

The National Library is exploring options for providing additional resources to the Network as a matter of urgency, since ABN is a business operated on the library community's behalf and we accept that a business solution must be found to the resource problem. In any case the Library cannot indefinitely warp decisions on its overall priorities by automatically giving ABN the first priority in all resource decisions. As part of these deliberations we are also exploring the opportunities to provide other services to the nation from the NBDB, including the possibility of products based on CD-ROM technology.

The establishment of ABN has been a significant influence in the decision of the National Library of New Zealand to establish a New Zealand Bibliographic Network and of the Singapore Government to establish SILAS, both of which operate on what is now the Washington Library Network system. The Chinese Government has also contracted for the introduction of a bibliographic service based on WLN, which is the software recently purchased by the British Library. These developments mean that there are now significant opportunities for sharing of resources, especially in our region, and Australia, New Zealand and Singapore recently for example held a meeting in Canberra to discuss common problems and opportunities for co-operation.

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Of broader significance is of course the fact that licensees of the WLN software are now quite important both in the United States and overseas in terms of the operation of that Network, and we have a critical need to be satisfied that WLN both recognises the importance of the licensees and is able to adequately service their needs. The National Library and some other licensees have a particular interest in ensuring the maximum shared development of the software enhancement burden, so that we are not unnecessarily duplicating each others work.

The Library has for some years been consciously committed to this principle, which was strongly argued for by all licensees at their last meeting with WLN in late 1985. We would be reluctant to move from this philosophical position, since any such decision would also clearly signal the possibility of examining whether we should now search for alternative software for the operation of ABN.

The introduction and development of ABN has been the outstanding success story of Australian librarianship in the last decade, and a very positive example of the nation's libraries harnessing their resources to develop the most cost effective and equitable mechanisms for library operations and resource sharing. Notwithstanding the impact of technology, which obviously suggests alternative and perhaps cheaper mechanisms for the supply of cataloguing information, I believe that participants would not likely surrender the advantages in resource sharing which ABN has brought. We are

also now moving into the effective use of ABN as an inter-library loan mechanism, and the development of the National Bibliographic Database is seen as essential by all major participants.

The next few years will nonetheless be a testing time for further development of ABN. The Australian dollar has in the last year suffered a massive and probable long term devaluation against almost all foreign currencies, and the Australian and State Governments are all operating under a policy of very strict constraint upon public sector operations. All libraries have suffered a consequent significant decline in their purchasing power for library materials, and most have also had significant cuts in real terms in their operational budgets. In these circumstances it is inevitable that the costs of ABN membership will be questioned against the perceived benefits and cost of alternative sources of bibliographical information, and it is already known that several major participants are concerned about what it was seen as other increased costs because of their material being included in the NBDB. I think it is beyond doubt that the increase in inter-library loan traffic which some major participants have seen in recent years is almost solely due to their holdings being now known to the library community through inclusion in the NBDB. In these circumstances it is incumbent upon the National Library and the Australian library community to contain ABN costs, promote the maximum development of its services and consciously address the broader opportunities for service to the nation which it offers.

I have no doubt there is a spirit of great goodwill towards ABN, but it will be interesting to see how harsh economic realities affects us. So far as the National Library is concerned we are very conscious of the impact ABN has had upon shared development of the nation's library services, and are committed to its positive future development.

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IFLA GENERAL CONFERENCE, TOKYO
1986
Division: Management and Technology
Section:
60-MAN-1-E

The Role and Use of Information Technologies and Databases for the Development of Information Management in Japan

by

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KEYWORD(S):

Information technology
Databases

For internal use only:
To be brought to meeting no:
56

Remarks:
to be presented orally ☒
for distribution only ☐

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1. Introduction

In recent years, the speed of technological innovation is very high and it has been crowned with great success such as semiconductors, new materials, opto-electronics and bio-technologies. Upon the basis of the remarkable progress in those high technologies, the information technology has undergone a complete transfigulation.

I will go into the details of the roles which such new information technologies have played for the improvement and advance of information management and documentation and , at the same time, of the direction which information management will take in the near future.

2. The characteristics of databases or database services

In this paper, database systems or database services shall fulfil the following three necessary conditions:

1) to contain a large quantity of informations in a computer-readable format,
2) to be searched by different access points combined, if necessary,
3) to be searched on-line at the place far apart from the host computer.

However, in several cases, the third condition will be ignored.

Databases or database services are different from traditional information media in the following points.

1) They make possible an access to a volume of in-

formation in a very short time.

2) They enable a user to search from many different access points, combining them, if necessary.

3) Users are able to make an access to almost world-wide databases, only by simple implements such as a terminal(a personal computer), an acoustic coupler, a modem, etc.

4) A rather simple charge system will allow a user to estimate an amount he will have to pay if he carries out the search, using the databases.

5) It is easier to process a group of information obtained through information retrieval activities.

By the way, the number of public databases available in Japan was 604 in 1982, 916 in 1983 and 1,242 in 1984, increasing by tens of percents every year.

3. The application of leading-edge technologies to information management and documentation

I will adopt the following scheme in order to review information technology and its application to information management and documentation.

1) The information cycle will be divided into three phases, i.e. production and storage, communication, retrieval and use.

2) The basic technology on both hardware and software will be shown according to each of three phases above-mentioned.

3) The results brought forth by the application of the above-mentioned basic technology will be presented.

4) The effectiveness of such results on information management and documentation will be studied.

Through this scheme, Table 1. has been introduced.

4. The production and storage of information

4.1 Basic technology

As hardware for information production, computers are the most important, because the amount of information produced in the computer-readable form has become far bigger than ever before. Computer type-setting system(CTS) produces a number of databases automatically in its editing and/or printing processes. As for information storage, opto-electronics is going to play the leading part.

Pattern-recognition, natural language processing, macnine translation, and artificial intelligence are the main softwares available in this field.

4.2 Production of information

4.2.1 Input technology

Automatic transcription technique of "kana" or Roman charadter into Chinese character adopted in most Japanese word processors have made the input work of Japanese language much easier than using the keyboard with Chinese characters themselves. Optical character recognition(OCR) of "kana" and Roman characters have already been put to practical use.

However, input technology itself is fairly behind

storage technology. This has made a serious bottleneck in the whole information cycle.

4.2.2 Language processsing and indexing

In the sentences written in Japanese, word division is seldom put into practice, while it is usual in European languages. Therefore, it is quite difficult to produce a database by automatic indexing from raw Japanese sentences. Recently, a software program to process raw Japanese sentences. It divides automatically the given sentences into individual words, taking much account of the grammatical rules. One can get a set of keywords, taking off useless words from the above-mentioned divided words. This is a step toward fully automaic indexing in Japanese langage.

On the other side, some experimental software is to support one who constructs and maintains a thesaurus, by processing logical relations among descriptors and non-descriptors automaically.

4.2.3 Full-text information service

Full-text database services have just started for two big Japanese newspapers, i.e. Nihon Keizai Shimbun(Japan Economic Journal) and Asahi Shimbun (the Asahi). The former is indexed by controlled vocabulary based on a thesaurus with hierarchical term relations, while the latter adopts free keywords supplemented by classification words. On the other hand, some dictionaries have just published also in CD-ROM. Anyway, people will have more full-text informations in such electronic

form in the future.

4.3 Storage of information

Paper has the longest history as an information medium, while microform, magnetic materials(magnetic tape, floppy disc, etc.) and optical storages (optical disc, CD-ROM, etc.) have joined the party. As for microform and optical storage, the following differences are indicated.

Microform excels in an ability of mass input, duplication, unified standard, lawful evidence and preservation, while optical storage outdoes in linkage with communication network, immediate processing and ease of updating. There are said to be no prominent differences in search speed, ease of search and density of record.

Therefore, optical storage is supposed to be mobiler as an information medium and is better adopted for complex use with other information technologies such as communication networks.

5. Communication

5.1 Basic technology

The marriage of computer and communication has brought the new horizon of information technology. Data communication system, digital network, optical fiber, satellite communication, etc. have produced bright fruit such as local area network(LAN), value added network(VAN), etc.

As for software, the standardization of protcol, etc. has done a major service. Especially, the standard specification of the public on-line ter-

minal for Japanese language issued in 1979 has made on-line access to databases a very easy one for nationwide users and brought the brighter era of on-line database services.

5.2 On-line access to databases

Formerly, one must go to the building of computer center or the place where the big terminal was located, in order to use and search databases. To make an access to databases abroad, one had to pay a very high cost of international telephone service or telex.

In 1978, Japan Information Center of Science and Technology(JICST) began its on-line database service through pulic telephone lines named JOIS-I, while in 1980, Kokusai Denshin Denwa Co.,Ltd(KDD) started a public data communication service, named ICAS(International Computer Access Service).

These two events marked the dawn of widespread on-line access to database services in this coun- Now, ICAS has been succeeded by more extensive service named VENUS-P(Value-added Enhanced Network Utility Service-Packetswitching), through which a large number of databases are served from or to Japan.

6. Retrieval and use of information

6.1 Basic technology

In the field of hardware, the introduction of computer was the most prominent. Computers were formerly used mainly to process numeric or code data, however recently they are used to handle

also literal information and have made the speed of information retrieval work much faster.

The spread of personal computer had large effect on people in making on-line database services much more familiar. Now, the amount of personal computer production in Japan was 1,870 thousand sets (1984), and we can see some personal computer in most offices and even some homes. A personal computer can be used not only as a terminal of a host computer, but also in order to construct a database within themselves.

As for software, Data Base Management System(DBMS) is very important. Now in Japan, famous mainframe computers are furnished by own DBMS's with similar functions. Users are able to construct private databases easily, using DDL(Data Definition Language).

6.2 Techniques of database use

Database sevice vendors have often and regularly seminars to help their customers to use their database sevices more easily, frequently and efficiently. There are many on-line user groups like Japan On-line Information User's Association(OUG). Besides, the first nationwide on-line searcher's license examination took place in Tokyo last year.

Intelligent search, downloading, method to process output obtained from database searches are the contemporary problems to be solved. On the other side, many firms have their own private databases, and 9.3% of all Japanese special li-

braries have experiances in developing and/or making use of their original databases.

However, the achivement level of the technology in the use of information is not as high as those of production and communication of information.

7. Further discussion

We have made a trmendous progress in information technology and, now, enjoy a good level of database services. The reference informations for books(MARC), journal articles, technical reports, patents, etc. and full-text of newspapers, etc. can be obtained from on-line database sevices, while business and finacial statisitics data and foriegn databases are also served.

However, the activities to construct new and original databases are not so lively. The difficulties in the technology to construct databases in Japanese is being overcome, as we have seen. I think this is rather an economic and social problem. Database construction and even service have been continuously faced with finanacial difficulties in too little return from the market. Financial support by the government will be necessary, and we all must have recognition and thought that information is nothing but an economic goods and should be paid reasonably to get. This thought that informaion is not free of charge any longer will really encourage the further development of information management, service and technology.

Table 1. The application of leading-adge technologies to information management and documentation

Database

	Production and storage	Communication	Retrieval and use
(H/W)	Computer Semiconducter Opto-electronics	Data comm. LAN, VAN, DDX Satellite comm Optical fiber	Computer Personal computer
Basic technology	Pattern-recognition Natural language processing	Standardization of protcols Networking technology	DBMS
(S/W)	Machine translation AI		
Applications to information mgt. and doc.	Word processor CTS Word division system Automatic indexing Thesaurus support s/w OCR input Electronic dictionary Optical storage Full-text database MARC	FAX Videotex CATV ICAS VENUS-P INS Electronic mail Electronic publishing Tele-computing	Personal computer as a intelligent terminal Construction of in-house DB Private file service Downloading On-line catalog Bibliometrics Citation analysis

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